Ch.26 CQ's: 12
Probs: 16, 18, 22

Conceptual Questions

26.C.12

a.) When Q is doubled

$\vec{E}_f = 2\vec{E}_i$

b.) When L is doubled

$\vec{E}_f = \frac{1}{4}\vec{E}_i$

c.) When d is doubled the electric field will remain the same.

$\vec{E}_f = \vec{E}_i = \vec{E}_i / \vec{E}_i = 1$

$E = \frac{\eta}{\epsilon_0}$ $\quad \eta = \frac{Q}{A}$ $\quad \eta = \frac{Q}{(2L)^2} = \frac{Q}{4L^2}$

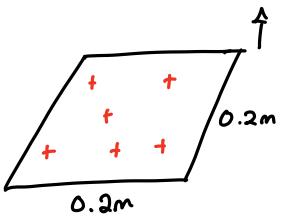
$E_1 = \frac{Q}{L^2 \epsilon_0}$ $\quad E_2 = \frac{Q}{4L^2 \epsilon_0}$

$\vec{E} = \frac{\eta}{\epsilon_0} = \frac{\frac{Q}{A}}{\epsilon_0}$

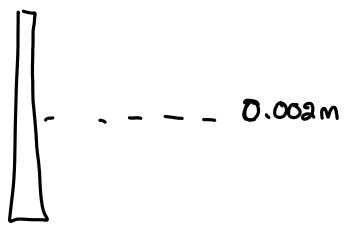
No dependence on d

Problems

26.P.16



$E = \frac{\eta}{2\epsilon_0}$



$Q = 8.0 \times 10^{-9} C$

$\epsilon_0 = 8.85 \times 10^{-12} \frac{C^2}{Nm^2}$

$\eta = \frac{Q}{A}$

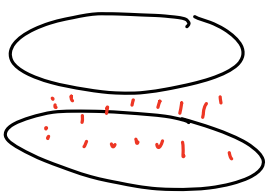
$A = 0.04 m^2$

$E = \frac{8.0 \times 10^{-9} C}{2(0.04 m^2)(8.85 \times 10^{-12} \frac{C^2}{Nm^2})}$

$E = 1.1 \times 10^5 N/C$

$E = 1.1 \times 10^5 N/C$

26.P.18



$\vec{E} = \frac{\eta}{\epsilon_0}$

$\eta = \frac{Q}{A}$ $\quad r = 0.03m$

$A = \pi r^2$ $\quad A = 0.009 m^2 \pi$

$A = 0.002827 m^2$

$E = 1.0 \times 10^6 N/C$

$1.0 \times 10^6 N/C = \frac{Q}{0.00287 m^2 \epsilon_0}$

$1.0 \times 10^6 N/C (0.00287 m^2) 8.85 \times 10^{-12} \frac{C^2}{Nm^2} = Q$

$Q = 2.5 \times 10^{-8} C$

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26.P.22

$x_1 = x_0 + v_0(\Delta t)$

$x_1 = x_0 + v_0\Delta t + \frac{1}{2}a\Delta t^2$

$v_1 = v_0 + a\Delta t$

$v_1^2 = v_0^2 + 2a(\Delta x)$

$x_f = d = \frac{1}{2}a(\Delta t)^2$

$v_1 = 4.0 \times 10^7 \text{ m/s}$

$v_0 = 2.0 \times 10^7 \text{ m/s}$

$\Delta x = 0.012 \text{ m}$

$v_1^2 - v_0^2 = 2a(\Delta x)$

$$\frac{v_1^2 - v_0^2}{2(\Delta x)} = a$$

$$\frac{(4.0 \times 10^7 \text{ m/s})^2 - (2.0 \times 10^7 \text{ m/s})^2}{2(0.012 \text{ m})} = a$$

$a = 5.0 \times 10^{16} \text{ m/s}^2$

$Q = 1.6 \times 10^{-19} \text{ C}$

$m = 9.0 \times 10^{-31} \text{ kg}$

$qE = ma$

$$E = \frac{ma}{q}$$

$$= \frac{(9.0 \times 10^{-31} \text{ kg})(5.0 \times 10^{16} \text{ m/s}^2)}{1.6 \times 10^{-19} \text{ C}}$$

$\vec{E} = 2.8 \times 10^5 \text{ N/C}$

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